

Petroleum Investigation And Petroleum System

Collected By:
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WELLSITE GEOLOGIST

Ministry of Petroleum



EGPC

supervise all petroleum activities above latitude line 28.



EGAS

organizing and diligently handling the activities of the natural gas resources of Egypt



GANOPE

supervise all petroleum activities under latitude line 28.



ECHEM

Egyptian Petrochemical Holding Company



EMRA

Egyptian Mineral Resources Authority

BID-ROUNDS PROCEDURES

1. GATHERING THE REGIONAL DATA FOR THE OFFERED BLOCKS

- PUBLISHED PAPERS
- OFFICIAL SURFACE GEOLOGICAL AND GRAVITY / MAGNETIC MAPS
- PERSONAL COMMUNICATIONS WITH THE TECHNICAL PEOPLE

2. QUICK EVALUATION AND RANKING THE BLOCKS

- ON THE BASIS OF GEOLOGICAL PARAMETERS SCORES AND STRATEGY PLAN

3. SELECTING THE TOP MOST LOW RISK BLOCKS

4. VISITING THE DATA ROOM FOR THE SELECTED BLOCKS

5. QUALITY CONTROL FOR THE EVALUATED AND RANKED BLOCKS

- PRELIMINARY GEOLOGICAL AND GEOPHYSICAL EVALUATION
- FINDING THE NEW PLAY CONCEPT
- PROSPECTIVITY AND RISK ANALYSIS FOR THE PRODUCED LEADS
- ECONOMIC STUDY AND EXPLORATION EXPENDITURE PROGRAM PHASES
- THE FINAL BID-IN OFFER PROGRAM RELATED TO THE COMPETITIONAL ITEMS , TERMS AND Company's STRATGEY

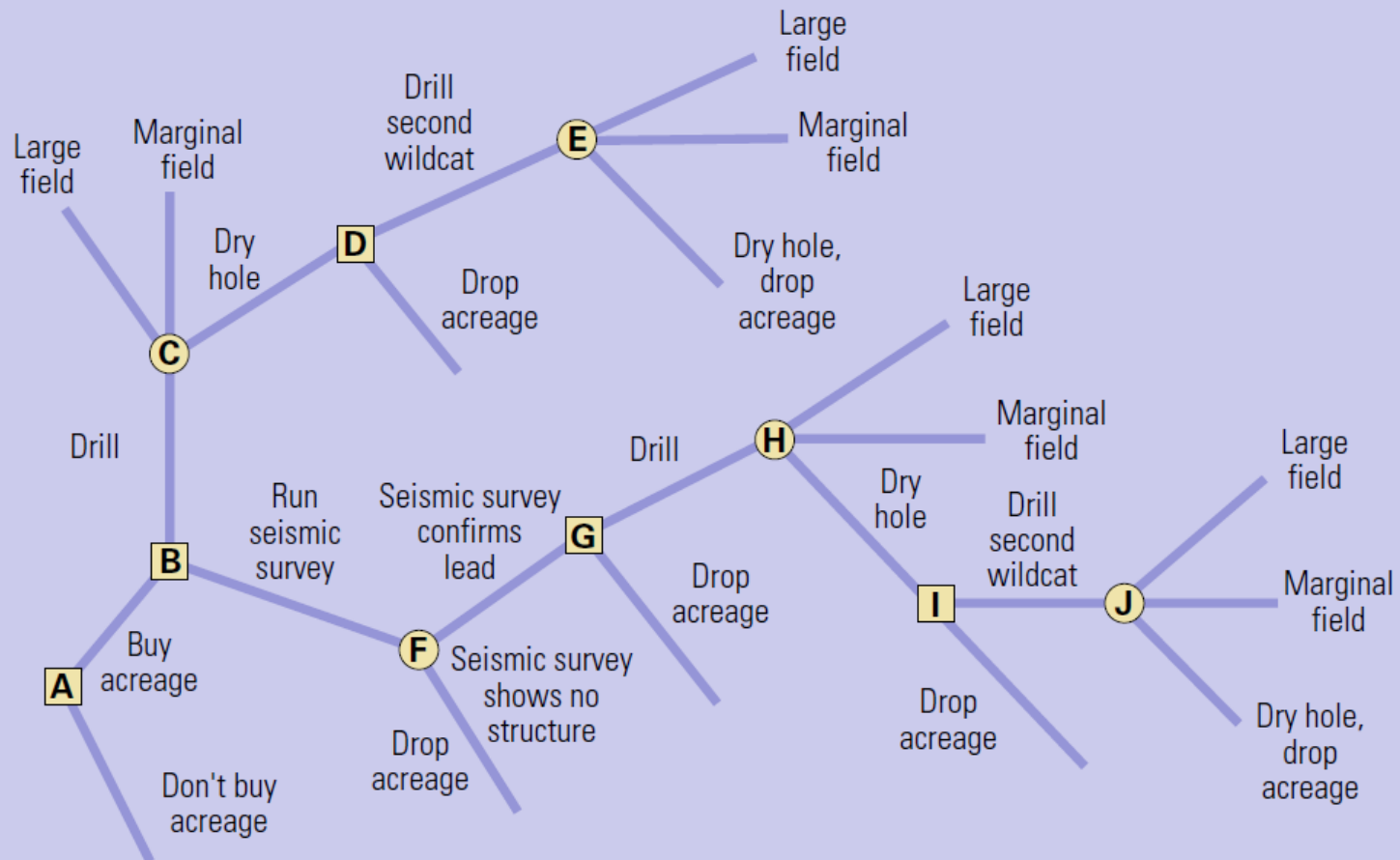
EXPLORATION WORK PROGRAM

1. ACQUIRING NEW DATA AS IN EXPLORATION PHASE SCHEDULE AND BUDGET
2. UPGRADING THE GEOLOGICAL AND GEOPHYSICAL EVALUATION UP TO THE NEW DATA
3. FINAL G&G EVALUATION WITH POSSIBLE LEADS INVENTORY
4. PROSPECT GENERATION AND PREPARING THE WELL RECOMMENDATION REPORTS FOR DRILLABLE LOCATIONS
5. STARTING DRILLING CAMPAIGN AND WELL GEOLOGICAL OPERATION
6. USING THE WELL RESULTS TO OVERVIEW THE EXPLORATION INTEREST

- GRAVITY, MAGNETIC, 2D AND 3D SEISMIC SURVEY
- NEW PROCESSING FOR THE EXISTED DATA SETS
- DATA TRADING WITH THE NEIGHBORS

- THE INTERPRETATION IS GOING IN PARALLEL AND AMENDING THE PLAY CONCEPT

Decision trees for decision-making in uncertain conditions. A decision tree sets out alternative courses of action and the financial consequences of each alternative, and assigns a probability to the likelihood of future events occurring. With this information, it is possible to determine the expected value of each outcome. Decision-makers use decision trees to clarify the consequences that alternative courses of action may have. Decisions are shown as branching points, or nodes, in the tree. Each possible outcome is shown as a branch. Decision trees can be simple with only a small number of branches and nodes, or complicated with many of them



Petroleum Investigation (Levels)



What is the first step in petroleum investigation ?

Petroleum Investigation (Levels)

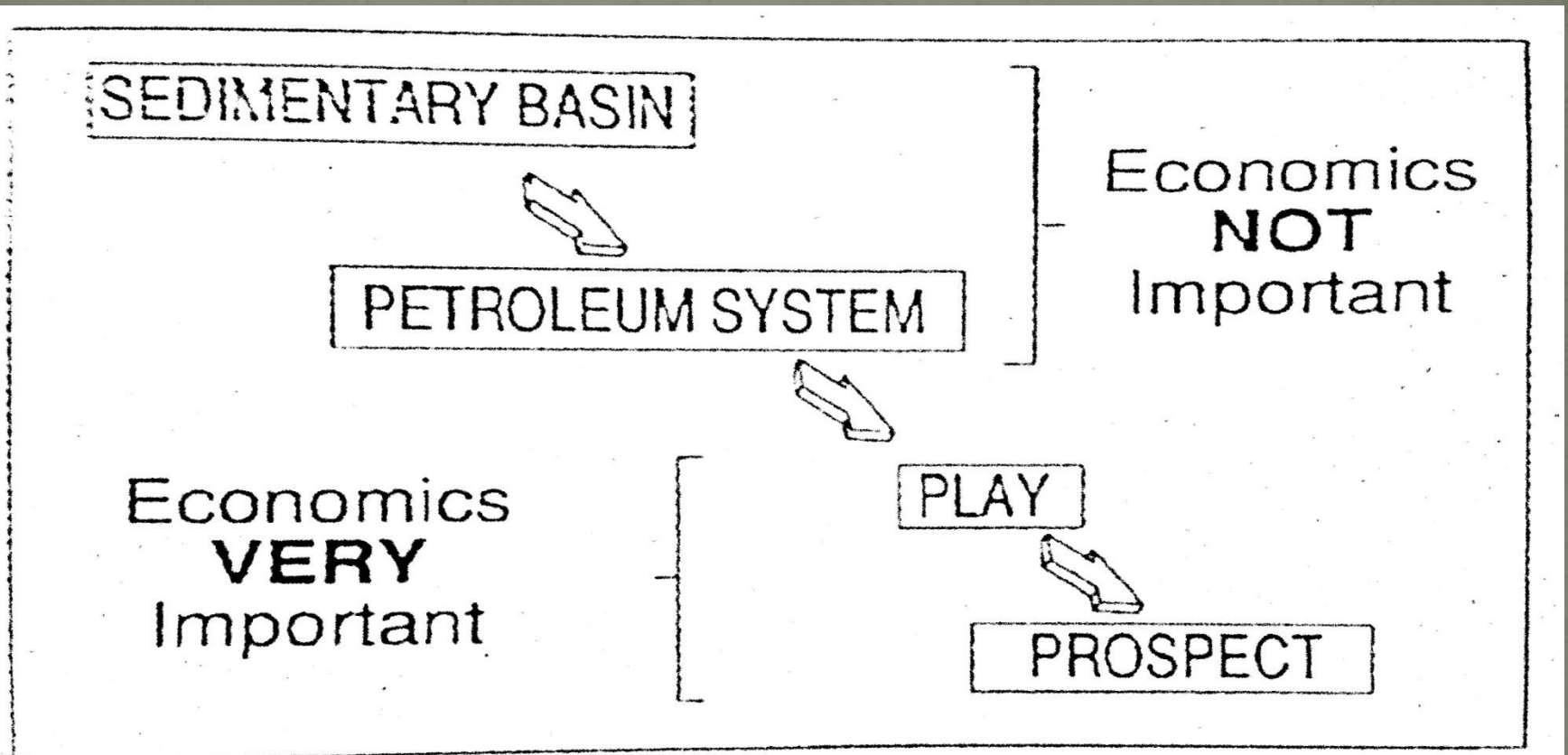


Figure 1.1. Four levels of petroleum investigation.

Sedimentary Basin

Sedimentary Basin

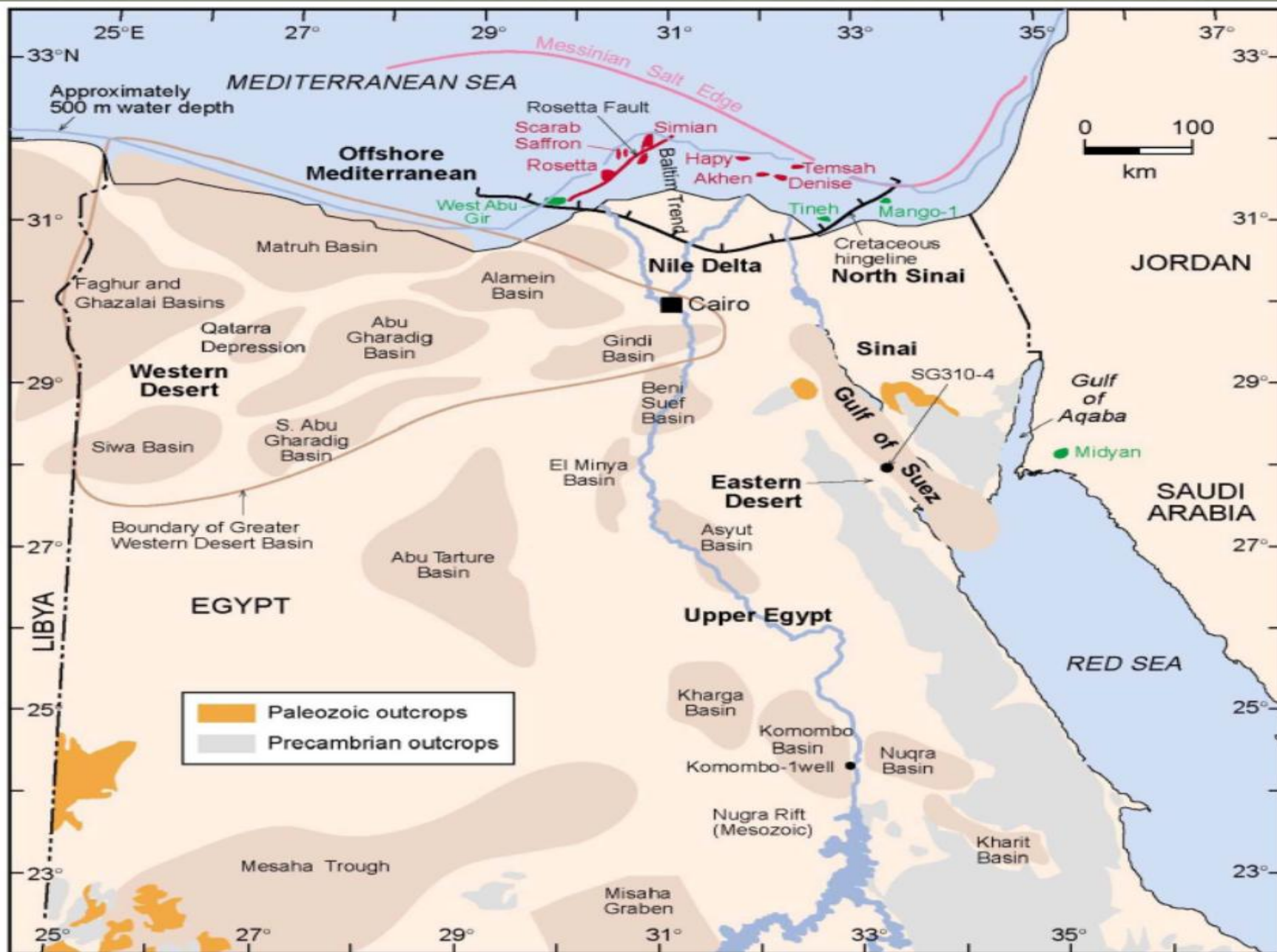
Stratigraphers Basin:

The location of sedimentary fill deposited in geological past.

Structural Geologists Basin:

A container created by tectonic process.

A low area in the earth's crust, of tectonic origin, in which sediments accumulate.



Sedimentary basins of Egypt (after Dolson et al., 2001).

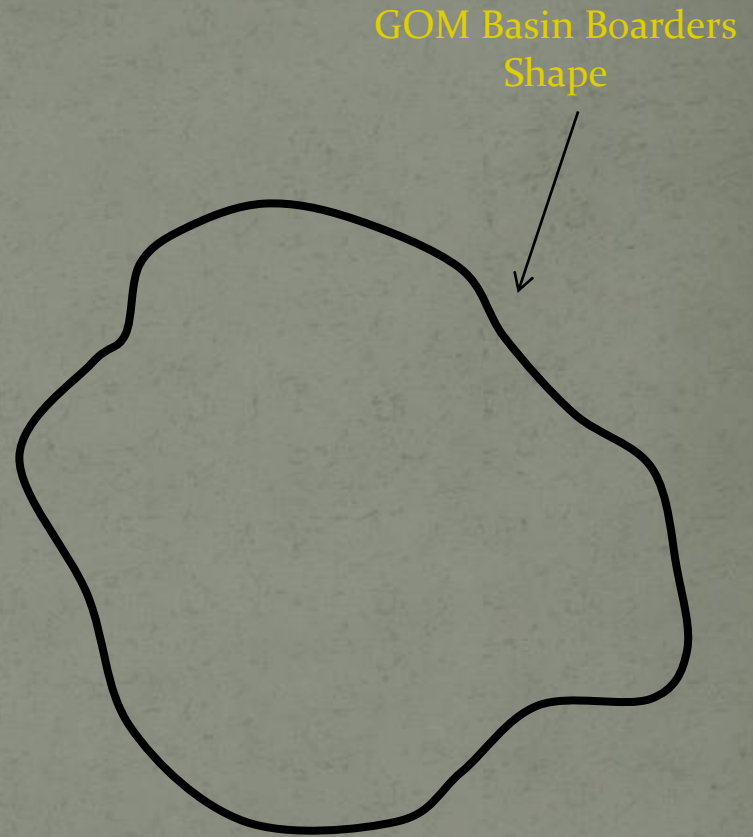
Sedimentary Basin Study Importance:

1. Basin Outline (Borders).
 2. Basin Formation History & Plate Tectonics (Type of Basin , Structure Framework & Thermal History).
 3. Basin Sedimentation History (Sedimentary Environments, Pale geographic Maps, Burial History).
 4. Depocenters.
- 

Sedimentary Basin Borders Identification:

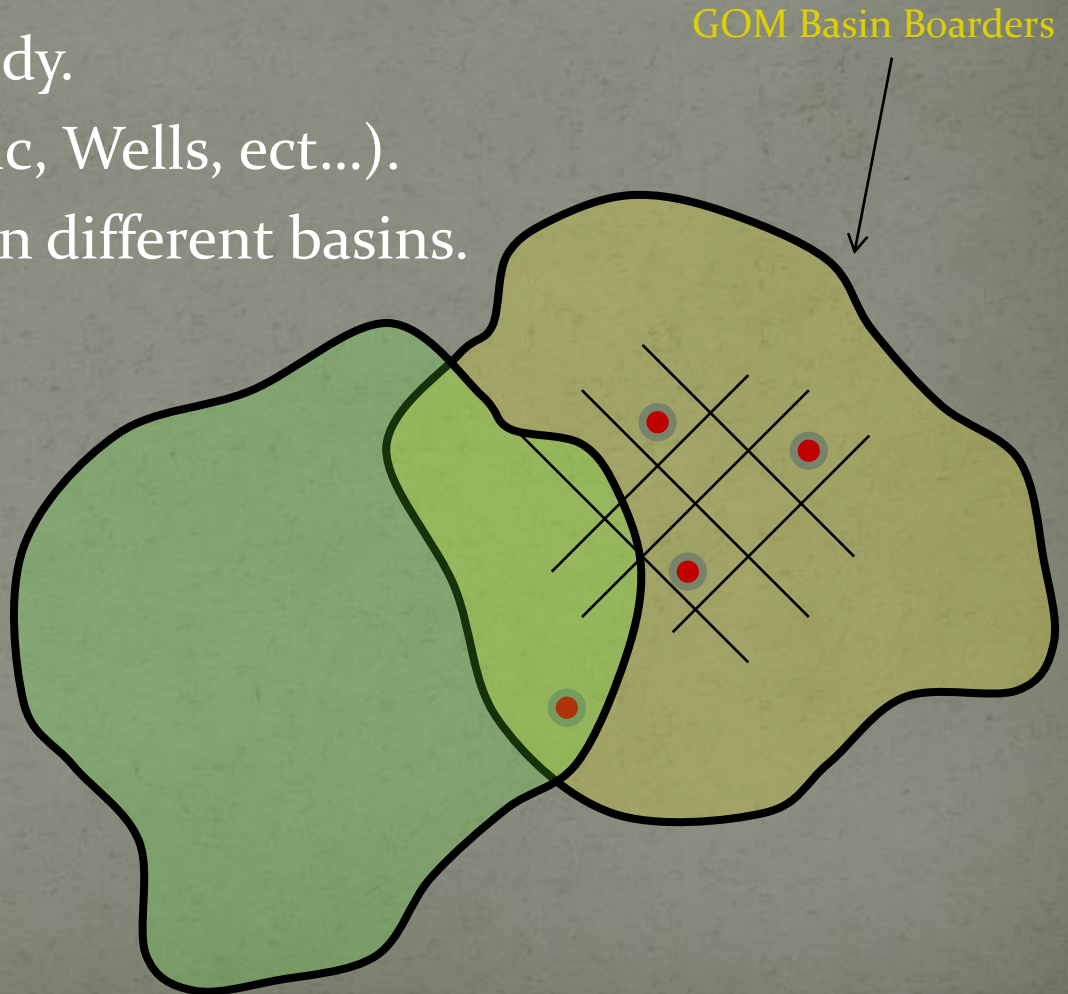
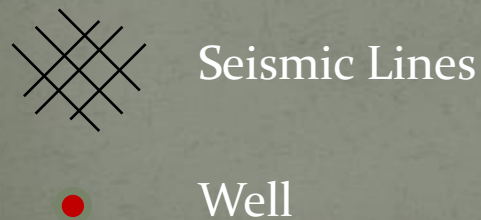


Why?



Sedimentary Basin Borders Identification:

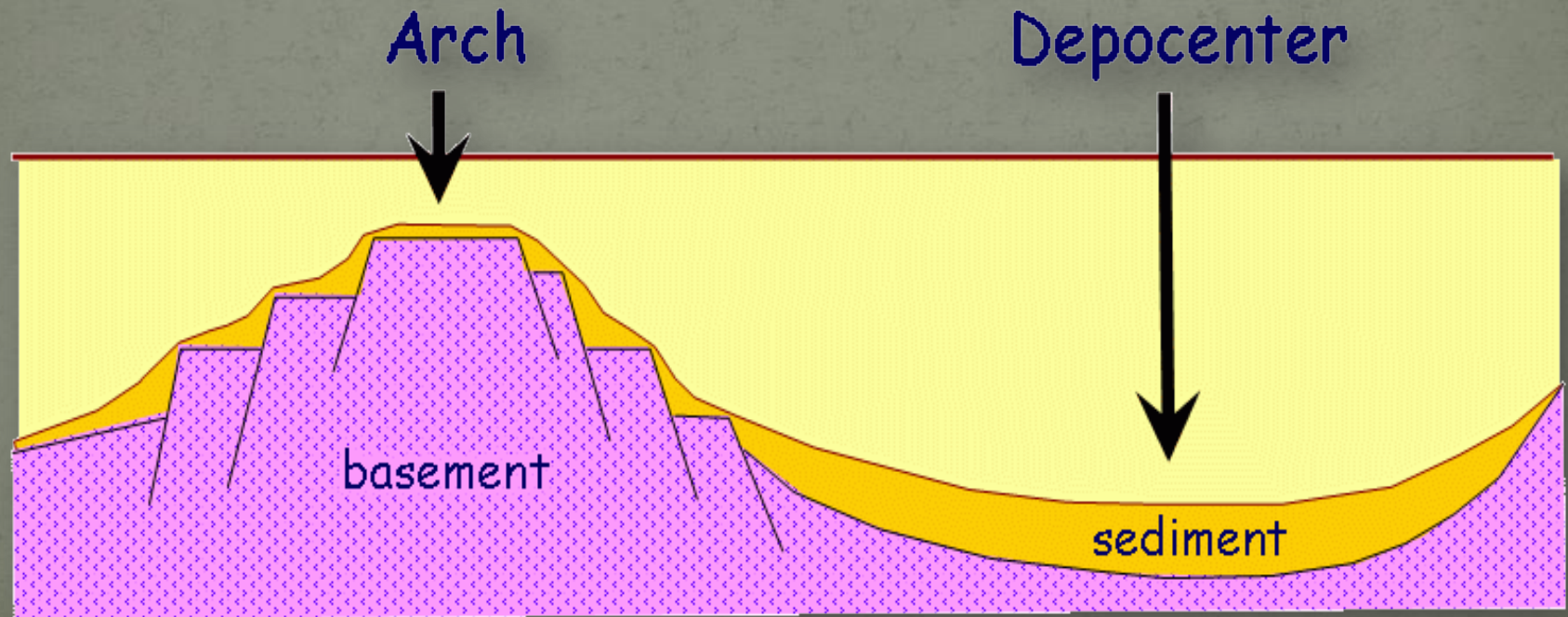
- Identify Area of Study.
- Cost Control (Seismic, Wells, ect...).
- Connectivity between different basins.



Sedimentary Basin

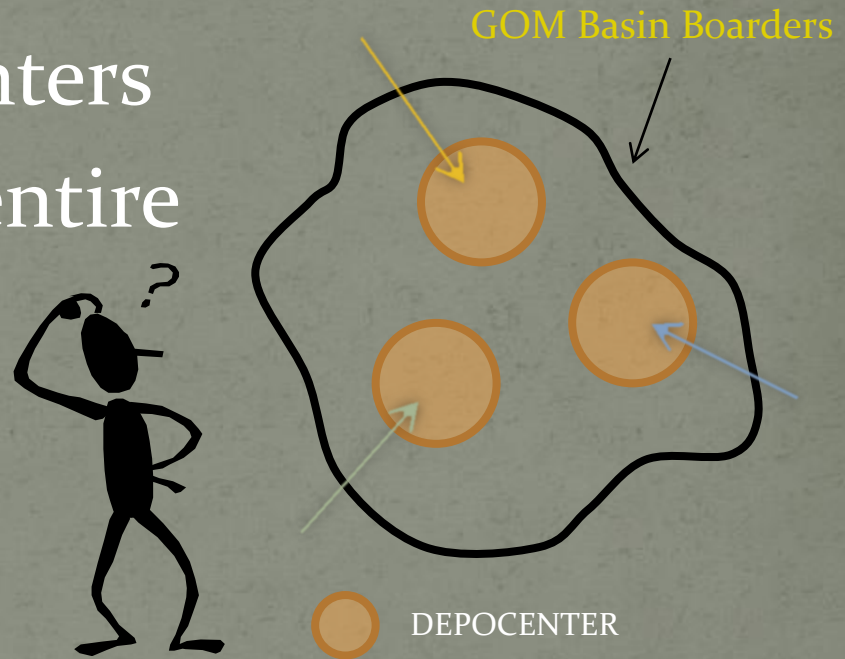
Depocenter:

The site of maximum deposition within a sedimentary basin, where the thickest development of the sedimentary sequence will be found.



Sedimentary Basin:

How many depocenters
we can find in our entire
basin ?



Note:

These different depocenters have unique histories of sediments accumulation , compaction , subsidence , deformation & thermal maturation of the potential hydrocarbon source rock.

Sedimentary Basin

Entire Basin



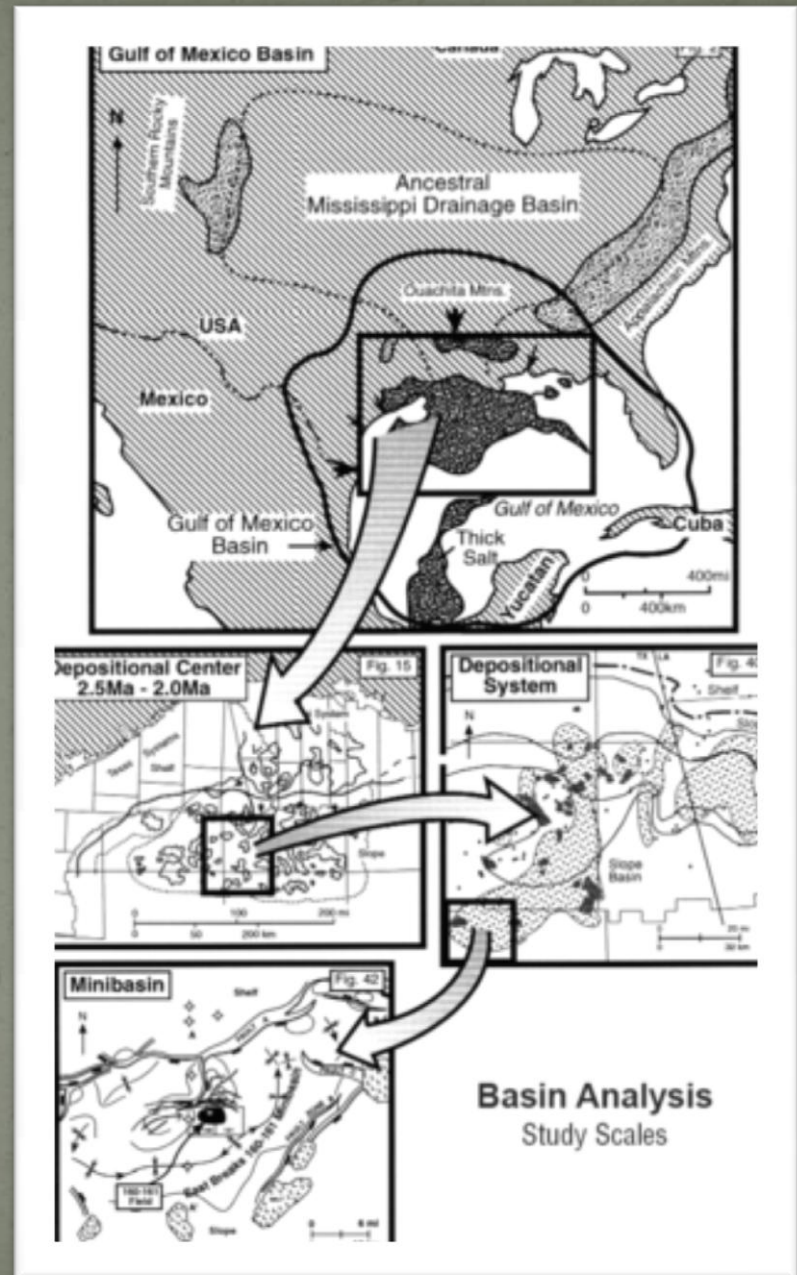
Sub Basin



Depocenter



Minibasin



Sedimentary Basin



Which type of Sedimentary basins is preferred in petroleum investigation ?

Petroleum System

Petroleum System Definition

- A natural system that encompasses a pod of active source rock and all related oil & gas & which includes all the geological elements and processes that are essential if a hydrocarbon accumulation is to exist.

Why we are proposing to revive, define & formalize the petroleum system concept ?

- The petroleum system approach is a way organizing information that lends it self to efficient investigation for purposes of exploration.
- The petroleum system studies describe the genetic relationship between a pod of active source rock and the resulting oil & gas accumulations.

Petroleum System:

Petroleum System Elements:

1. Source Rock.
2. Reservoir Rock.
3. Seal Rock.
4. Trap.
5. Migration Path Way.

Petroleum System Processes:

1. Generation.
2. Migration.
3. Accumulation.

Petroleum System Elements:

Source Rock:

A rock rich in organic matter which, if heated sufficiently, will generate oil or gas.

Reservoir Rock:

A subsurface body of rock having sufficient porosity and permeability to store and transmit fluids.

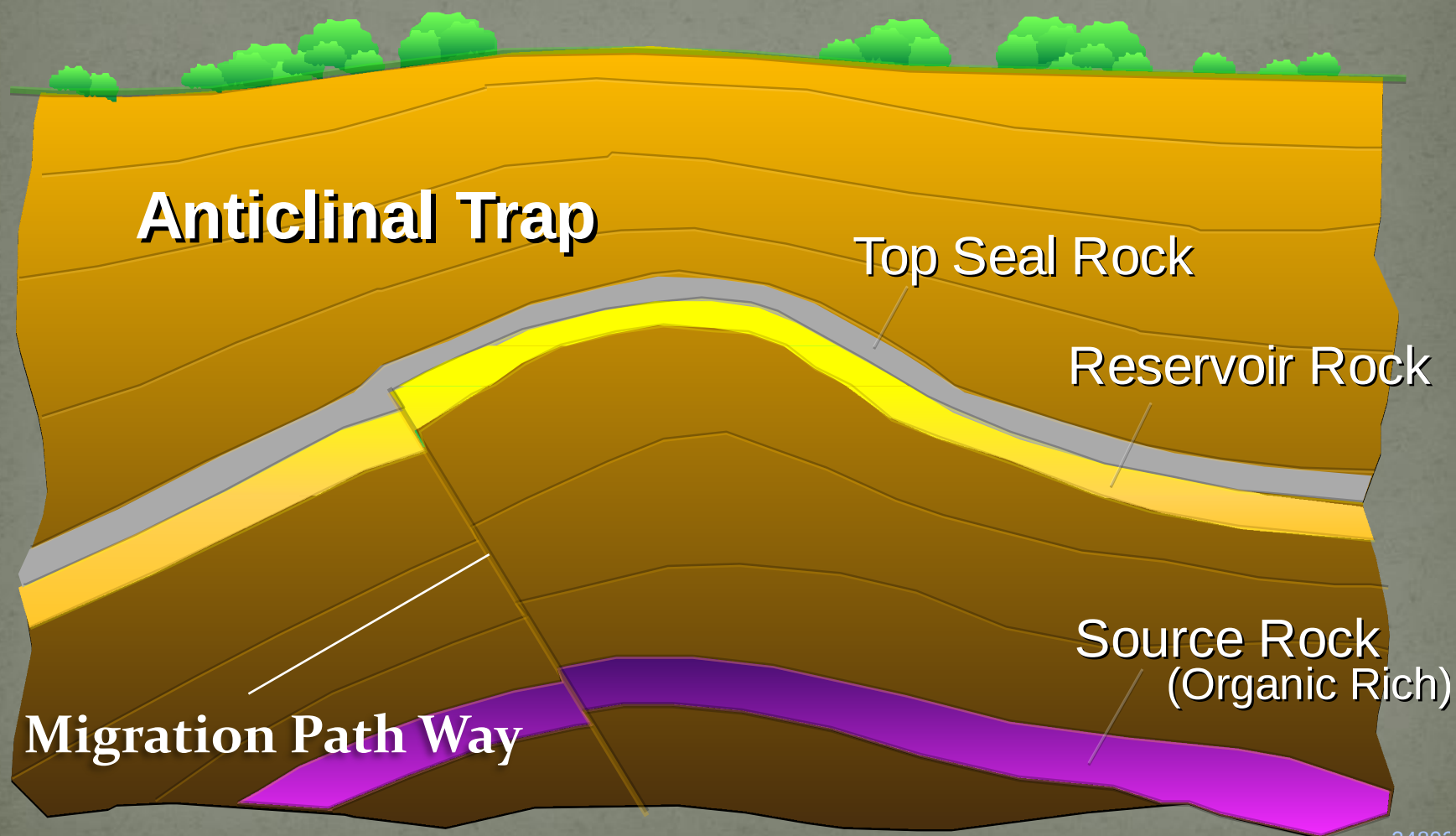
Seal Rock : (Cap Rock)

A relatively impermeable rock that forms a barrier or cap above and around reservoir rock such that fluids cannot migrate beyond the reservoir.
(commonly shale, anhydrite or salt)

Trap:

The structural and stratigraphic configuration of rocks suitable for containing hydrocarbons and sealed by a relatively impermeable formation through which hydrocarbons will not migrate.

Petroleum System Elements:



Petroleum System Elements:

Generation: (Maturation)

The formation of hydrocarbons from a source rock as bitumen forms from kerogen and accumulates as oil or gas.

Migration:

The movement of hydrocarbons from their source into reservoir rocks.

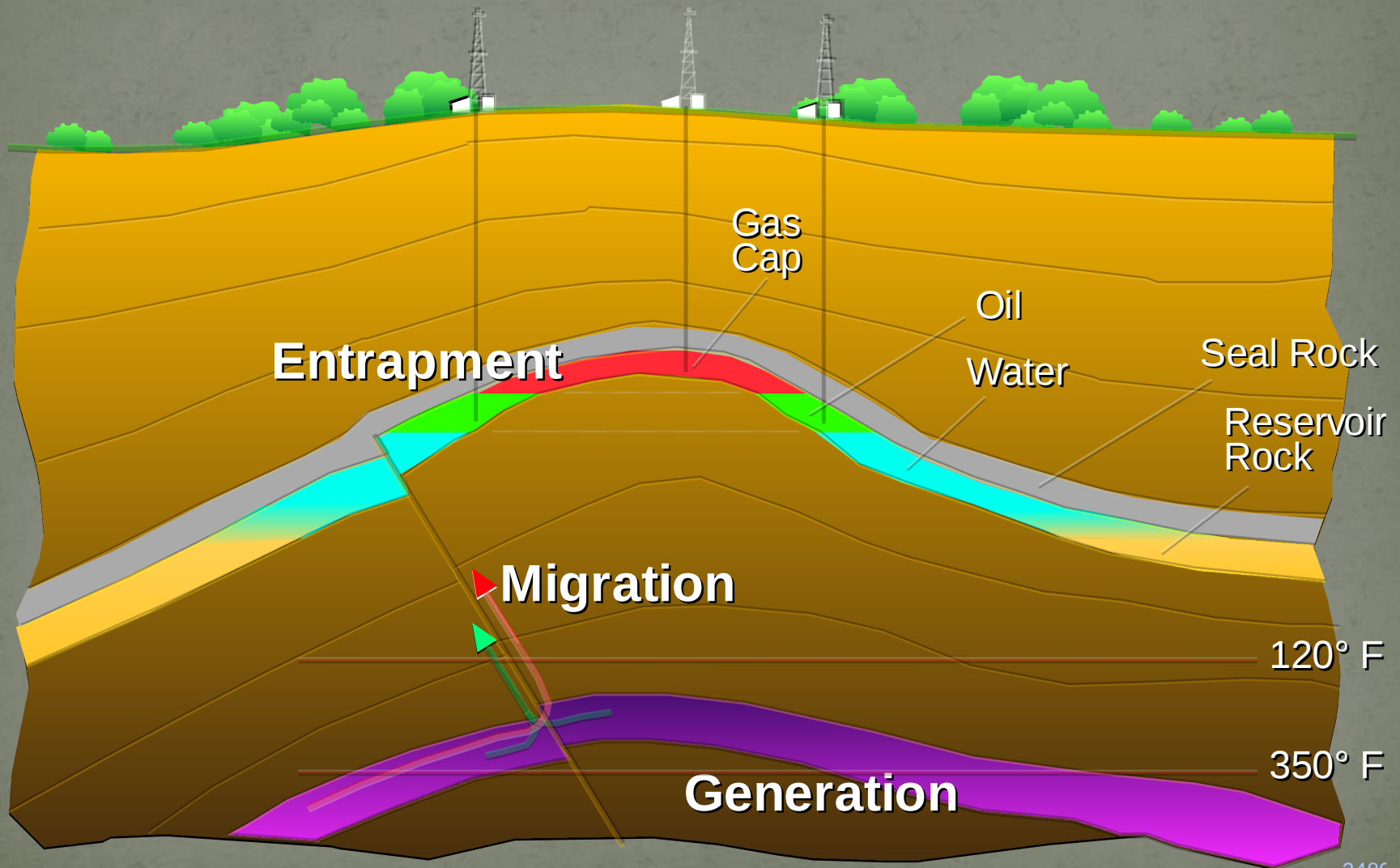
Accumulation: (Entrapment)

The phase in the development of a petroleum system during which hydrocarbons migrate into and remain trapped in a reservoir rock.

Traps vs. Accumulations:

- A trap may or may not contain oil or gas.
- Accumulations, or pools, are traps that contain oil or gas.

Petroleum System Processes:



Sedimentary Basin



Which type of basins is preferred in petroleum investigation ?

Sedimentary Basin

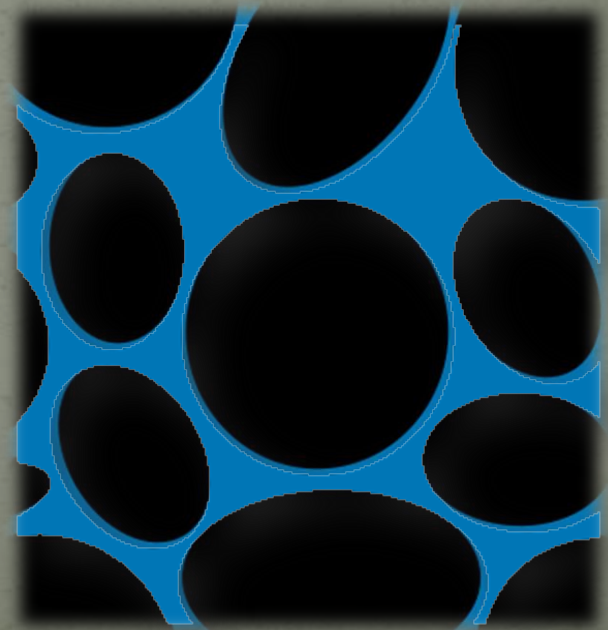


Petroleum System (Reservoir Rock):

- A subsurface body of rock having sufficient porosity and permeability to store and transmit fluids.

Porosity:

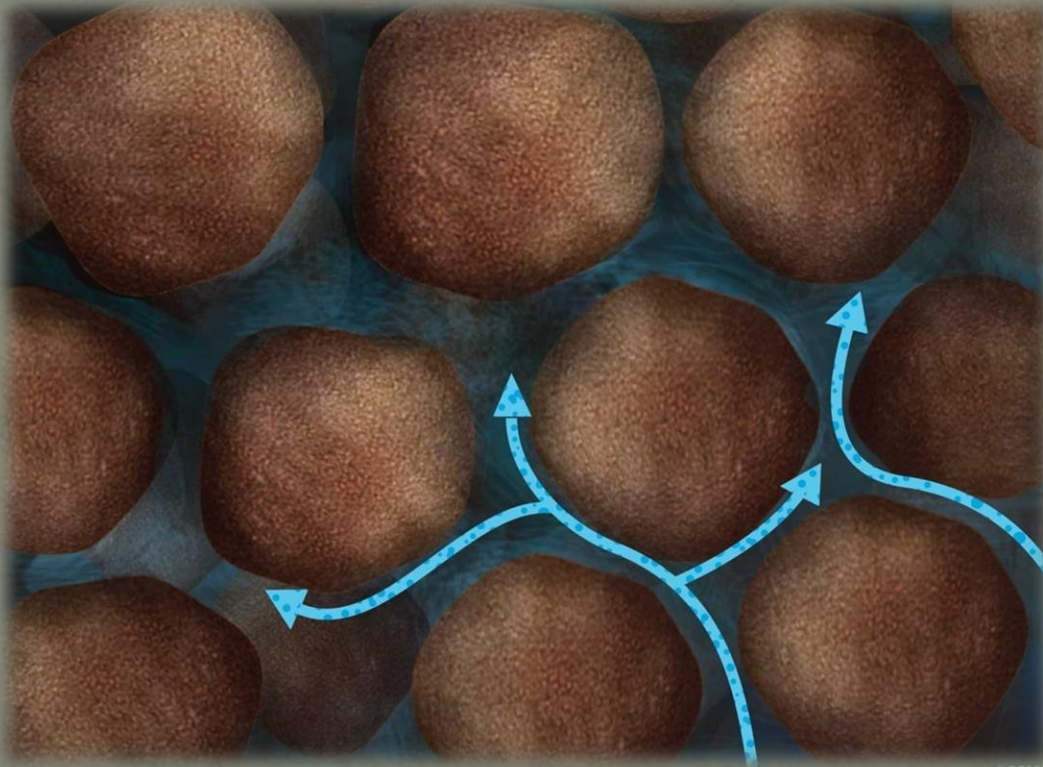
The percentage of pore volume or void space, or that volume within rock that can contain fluids.



Petroleum System (Reservoir Rock):

Permeability:

The ability, or measurement of a rock's ability, to transmit fluids, typically measured in darcies or millidarcies.



Petroleum System (Reservoir Rock):

- Reservoir Rock Types:

1. Sand Stone.
2. Lime Stone. (Fractured)
3. Basement. (Fractured)

Petroleum System (Reservoir Rock):

<http://assets.geoexpro.com/legacy-files/2008%20-%20Vol%205/No%204/Mali%20A%20country%20on%20the%20Cusp/maintarget464.jpeg>



- Fractured Limestone

Petroleum System (Reservoir Rock):

<http://3.bp.blogspot.com/-bxpZbe63PtW/TzndSzzikK1/AAAAAAAAAe4/o7QWCGwgap8/s640/shutins4.JPG>

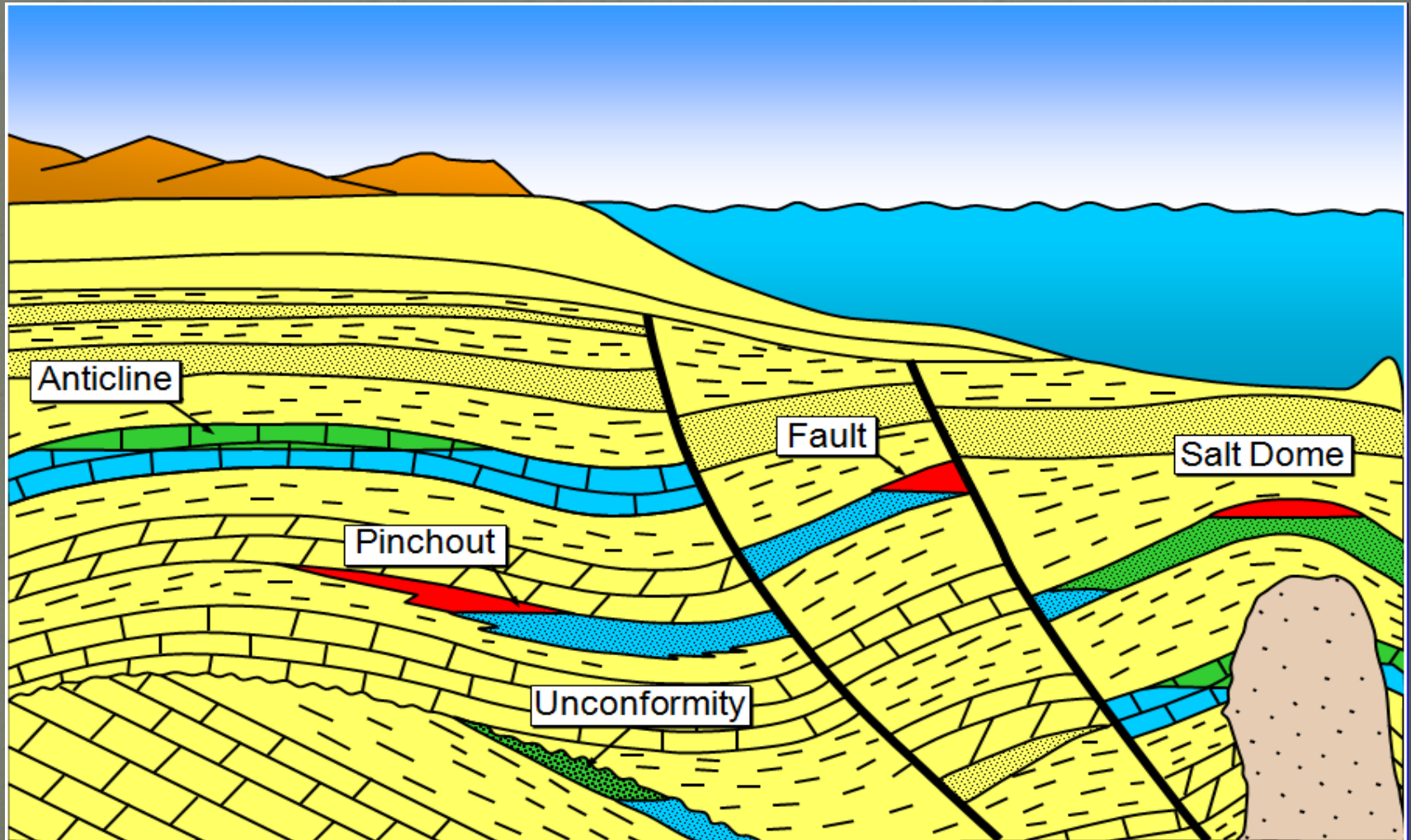


- Fractured Basement Rock

Petroleum System (Trap):

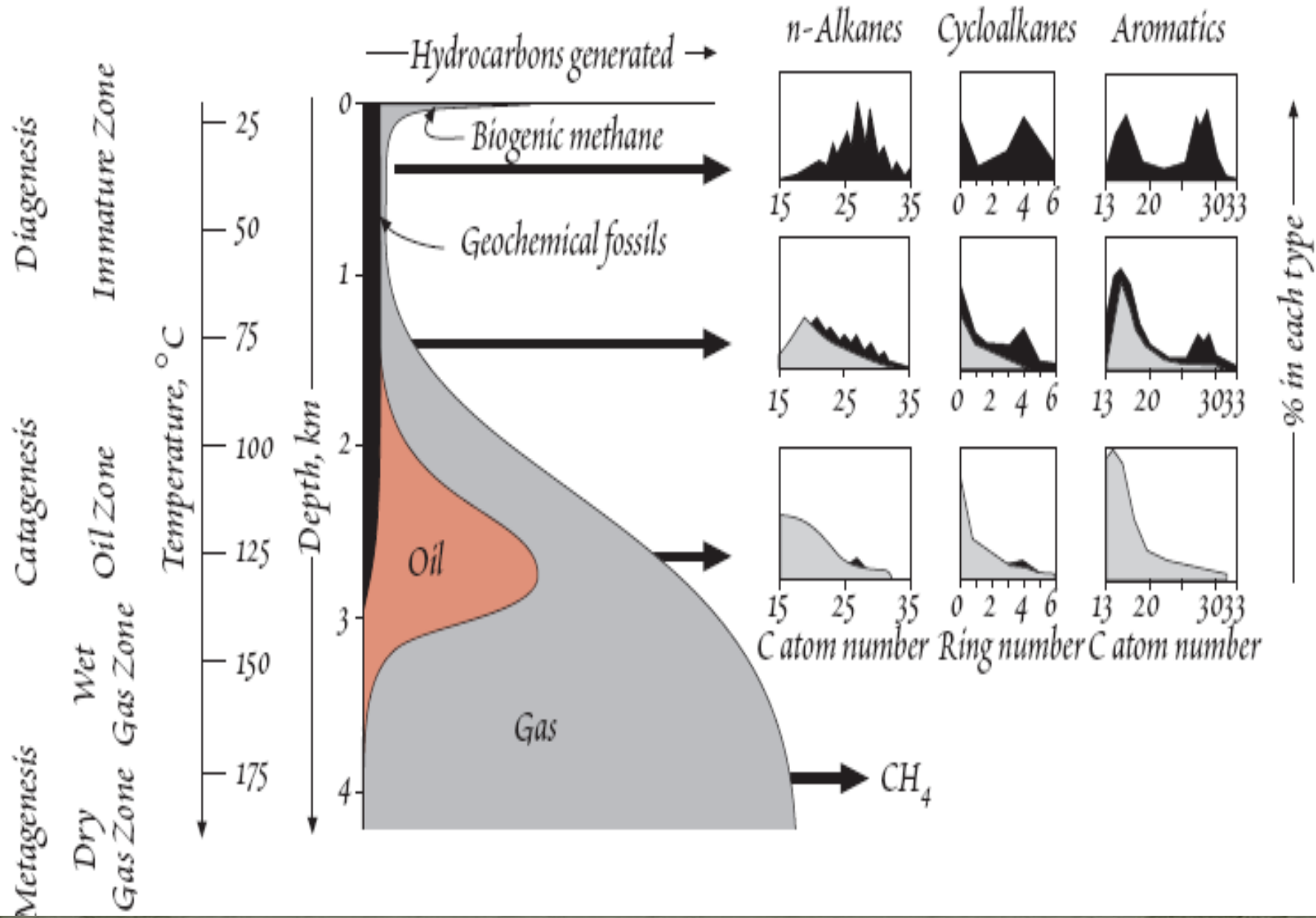
- The structural and stratigraphic configuration of rocks suitable for containing hydrocarbons and sealed by a relatively impermeable formation through which hydrocarbons will not migrate.

Petroleum System (Trap):



Petroleum System (Generation):

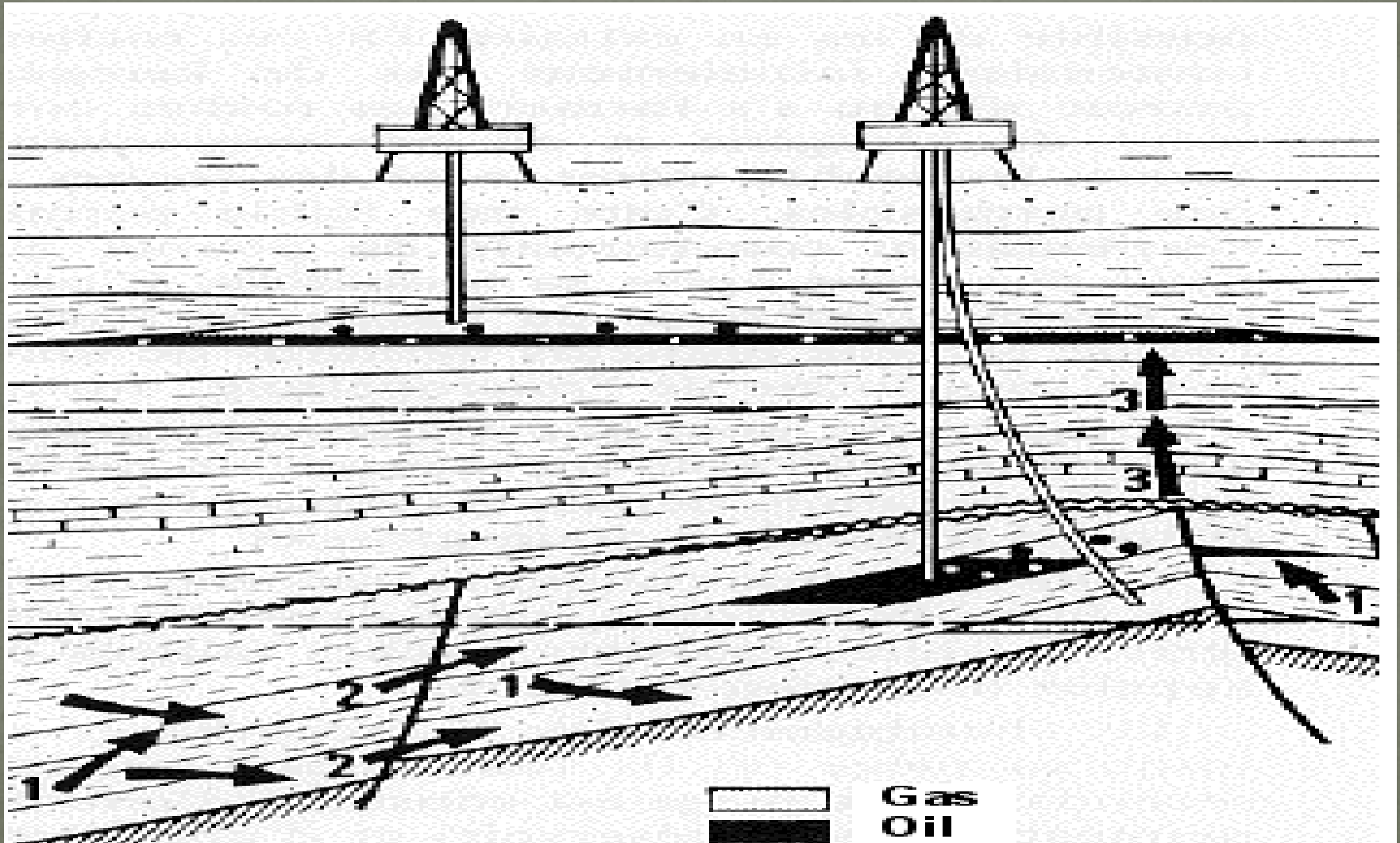
- The formation of hydrocarbons from a source rock as bitumen forms from kerogen and accumulates as oil or gas.



Petroleum System (Migration):

- The movement of hydrocarbons from their source into reservoir rocks.
- Primary Migration:
The expulsion of newly generated hydrocarbons from a source rock.
- Secondary Migration:
The movement of generated hydrocarbons into a reservoir after their expulsion, or primary migration, from a source rock.
- Tertiary Migration (Remigration):
Oil "escapes" from a reservoir where it previously accumulated.

Petroleum System (Migration):



Organic
Matter



Rock

Source
rock

Not Source
rock

Potential

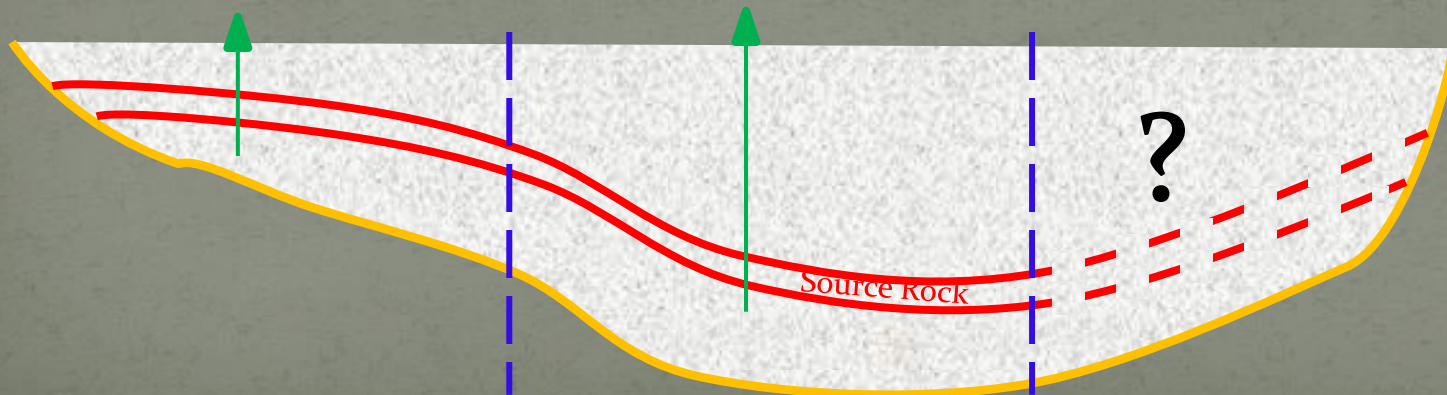
Effective

Possible

Need
more thermal
maturity to generate HC

Already generated
and expelled
HC

Source potential has not
yet been evaluated



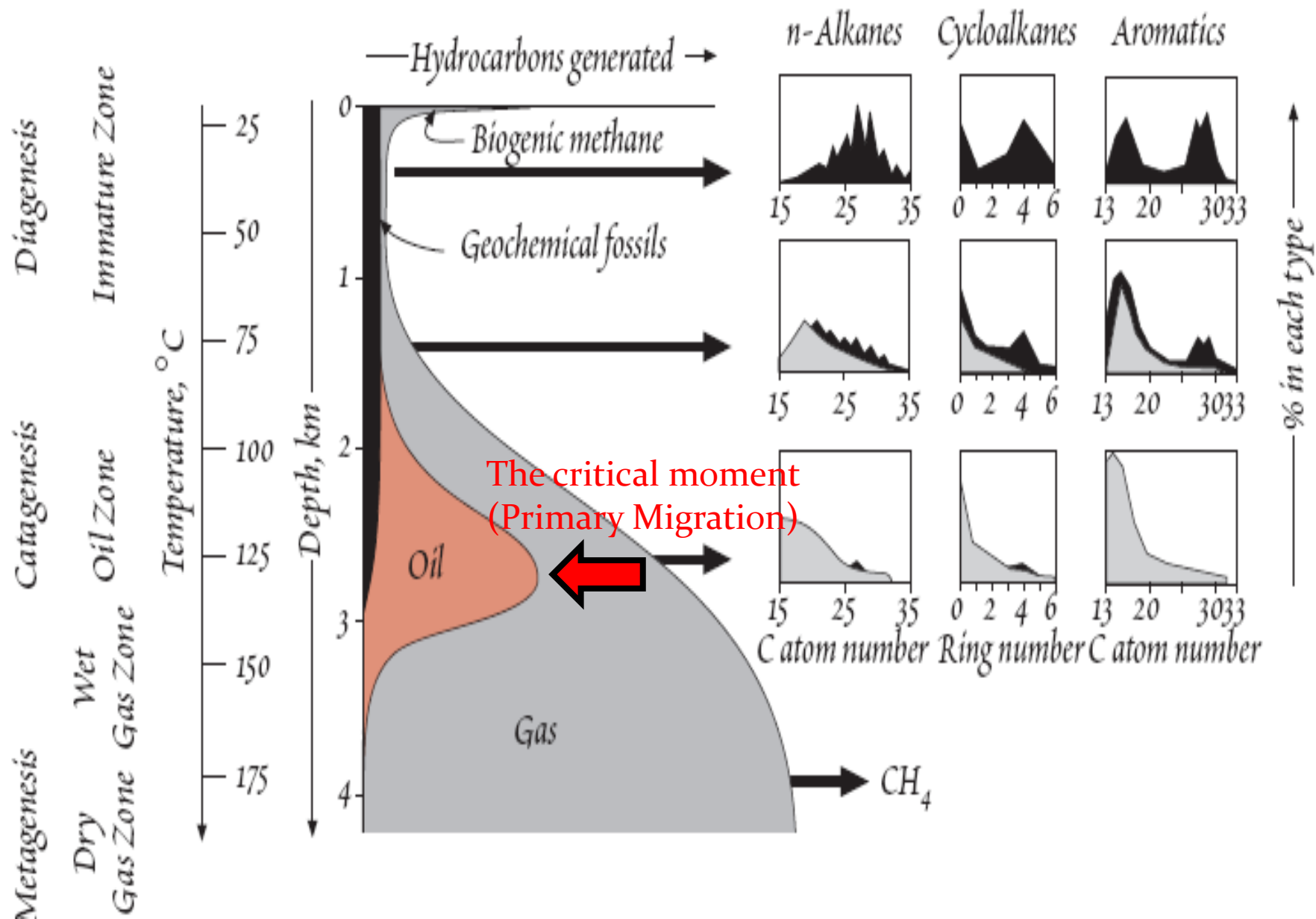
Petroleum System (Migration):

- The critical moment:

Is the time of highest probability of entrapment and preservation of hydrocarbons in a petroleum system-after traps form and hydrocarbons migrate into a reservoir and accumulate-and marks the beginning of preservation in a viable petroleum system.

- Petroleum System Age:

Is the time range of generation, migration & accumulation start when the source rock reach the top of oil window till reach the top of gas window (Dry Gas Zone).



Burial History Chart

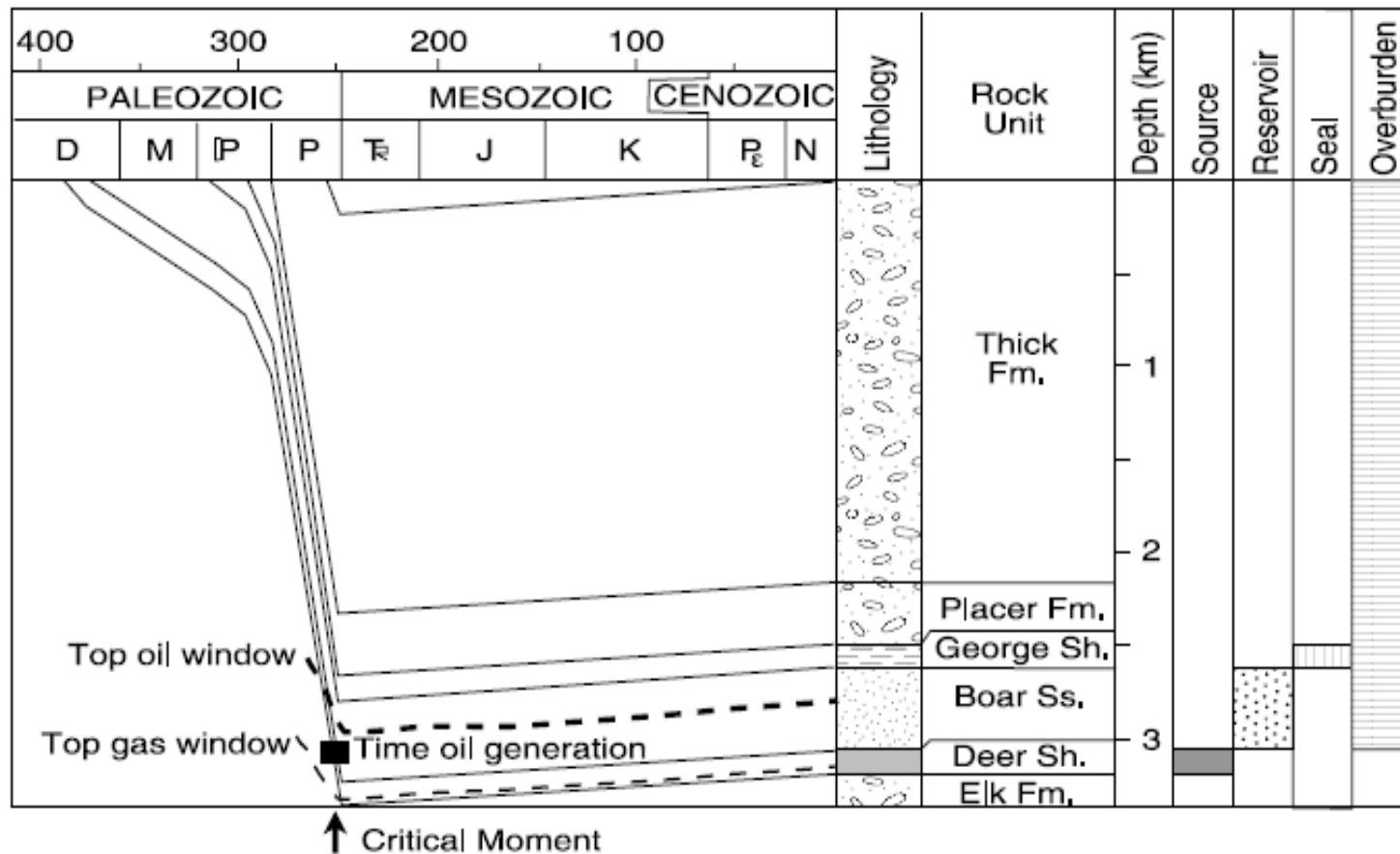
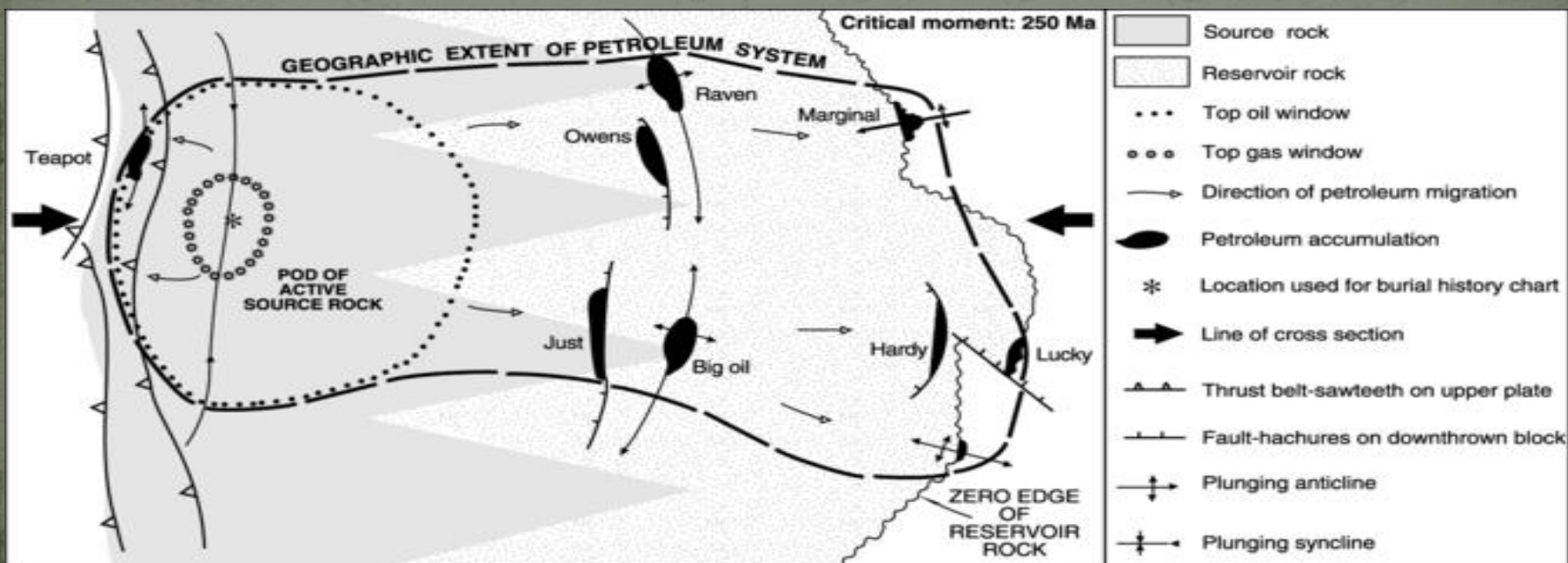
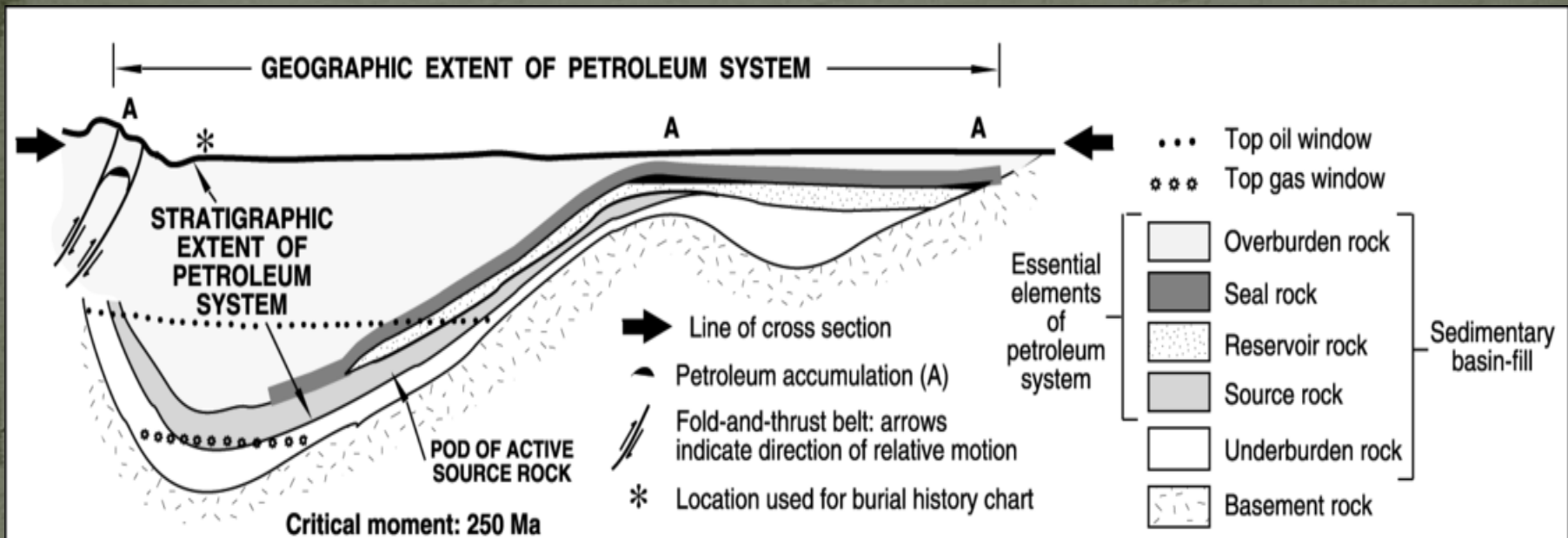
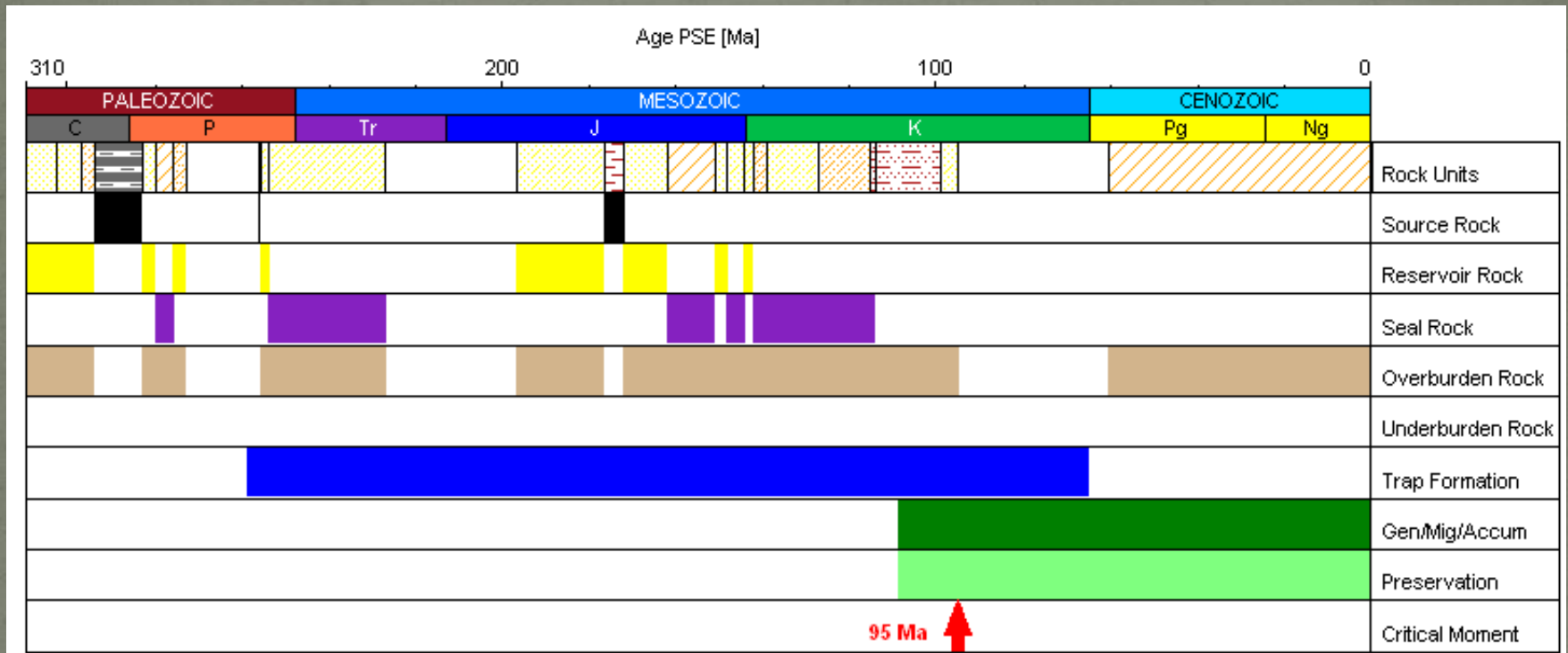


Figure 3-3. From Magoon and Dow, 1994; courtesy AAPG.



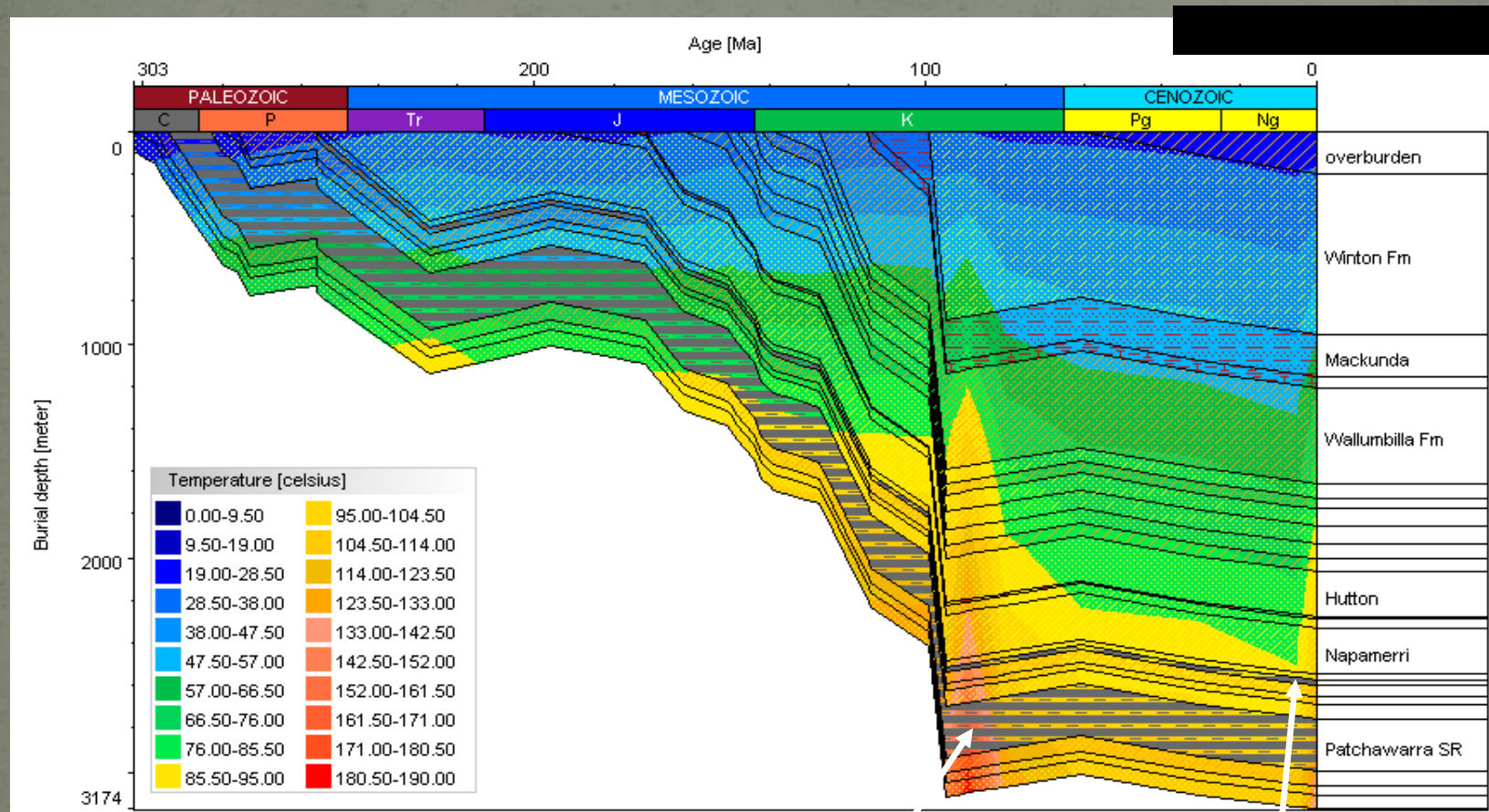
Events Chart



Critical Moment

All the elements of the Petroleum System were in place by the Critical Moment

1D Basin Modelling:



High heat flow spike 100-90 Ma

2- 5 Ma rise in heat flow

Petroleum System Name:

- The name of petroleum system includes the source rock name followed by the name of the major reservoir rock and then symbol expressing the level of certainty.

Petroleum System Name: (Level of Certainty):

- Known Petroleum System (!):

A good geochemical match exists between the active source rock & the oil or gas accumulation.

- Hypothetical Petroleum System (.):

Geochemical information identifies a source rock, but no geochemical match exists between the source rock & the petroleum accumulation.

- Speculative Petroleum System (?):

The existence of either a source rock or petroleum is postulated entirely on the basis of geological or geophysical evidence.

Petroleum System Name: (Example)

Khatatba –Bahariya (!)



*thank
you!*

References

- Schlumberger Glossary.
- Curtis P. Henderson (Oil Presentation).
- Magoon ,L. B, and W. G. Dow, eds., 1994, The petroleum System-from source to trap: AAPG Memoir 60.
- John M. Armentrout, CH 4. Sedimentary Basin Analysis, Exploring for Oil and Gas Traps, AAPG.
- (Organic Geochemistry Presentation of Geology Department, Faculty of Science, Cairo University) compiled by: Prof. Ahmed El-Kammar & Assoc. Prof . Mohamed El-Kammar
- BUSINESS OPPORTUNITY FOR PETROLEUM EXPLORATION. PRESENTATION PROF.ADEL EL SEHEAM